Claims

1. An equipment diagnosis device comprising:

instrument means for measuring a plurality of instrumentation amounts for the equipment sucking and

5   discharging a fluid;

arithmetic means for performing the arithmetic operation on the correlation between the plurality of instrumentation amounts that are measured; and

normal state quantity storage means for storing the state

10 quantities including at least the correlation between said plurality of instrumentation amounts as the state quantities in the normal condition of said equipment, the state quantities being arithmetic values such as a mean value obtained from the instrumentation amounts measured when the operation is judged

15 to be normal;

characterized in that the state quantities of the abnormal condition are obtained by making the arithmetic operation from the state quantities of the normal condition stored in said normal state quantity storage means.

20   2. An equipment diagnosis device comprising:

instrument means for measuring a plurality of instrumentation amounts for the equipment sucking and discharging a fluid;

arithmetic means for performing the arithmetic operation

25 on the correlation between the plurality of instrumentation

amounts that are measured;

normal state quantity storage means for storing the state quantities including at least the operated correlation between said plurality of instrumentation amounts as the state quantities in the normal condition of said equipment, the state quantities being arithmetic values such as a mean value obtained from the instrumentation amounts measured when the operation is judged to be normal;

abnormal state quantity storage means for presetting a threshold to judge the state quantities in the abnormal condition; and

judgement means for judging at which the current state quantities are among at least threes or more stages, including a normal stage, an abnormal stage and an intermediate stage between the normal or abnormal stages by comparing the current state quantities including at least the state quantity in which said arithmetic means makes the arithmetic operation on the correlation between said plurality of instrumentation amounts for said fluid as the variables during the current operation of said equipment and the state quantities of the normal state stored in said normal state quantity storage means or said threshold.

3. An equipment diagnosis device comprising:

instrument means for measuring a plurality of instrumentation amounts for the equipment sucking and

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discharging the fluid;

arithmetic means for performing the arithmetic operation on the correlation between the plurality of instrumentation amounts that are measured;

state quantity storage means for storing the state quantities including at least the operated correlation between said plurality of instrumentation amounts as the state quantities in the normal condition of said equipment, the state quantities being arithmetic values such as a mean value obtained from the instrumentation amounts measured when the operation is judged to be normal, or storing the state quantities including at least the correlation between the plurality of instrumentation amounts operated by said arithmetic means from the plurality of instrumentation amounts measured when said equipment is judged as the abnormal condition or set to achieve the abnormal condition as the state quantities in the abnormal condition of said equipment; and

judgement means for inferring the extent or cause of abnormality if it is judged that the current operating condition is not the normal state by comparing the current state quantities including at least the state quantity in which said arithmetic means makes the arithmetic operation on the correlation between the plurality of instrumentation amounts for said fluid as the variables during the current operation of said equipment and at least one of the state quantities of the normal state and

the state quantities of the abnormal state which are stored in said state quantity storage means.

4. The equipment diagnosis device according to claim 1, 2 or 3, characterized by further comprising comparison means for comparing the distances between the current state quantities in the current operating condition including at least the state quantity obtained by arithmetic operation on the correlation between said plurality of instrumentation amounts as a plurality of variables with the state quantities of said normal condition or abnormal condition that are stored, wherein the degree of abnormality in the operating condition is judged from a change in the distance from the state quantities of said normal state or the state quantities of said abnormal state, while said comparison means repeats the comparison in the operating condition.

5. The equipment diagnosis device according to any one of claims 1 to 4, characterized in that the state quantities of said current operating condition or the state quantities of said abnormal condition provide a plurality of different aggregates having different instrumentation amounts or variables.

6. The equipment diagnosis device according to any one of claims 1 to 5, characterized in that the degree of abnormality of the state quantities in the current operation can be displayed by classifying the distances between the state quantities of

said normal state and the state quantities of said abnormal state.

7. The equipment diagnosis device according to any one of claims 1 to 6, characterized in that a range for setting the normal operating condition or a threshold for judging the abnormal state is acquired by having the instrumentation amounts that are measured or the arithmetic values such as a mean value obtained from said instrumentation amounts, converting compulsorily at least one of said measurement amounts or said arithmetic values into another value, and making the arithmetic operation on the composite variables including the value after conversion.

8. The equipment diagnosis device according to any one of claims 1 to 7, characterized in that said judgement means judges whether the operating condition of the fluid equipment such as a compressor, a pump or an air blower that treats a combustible fluid or a fluid harmful to the human body, or a driving apparatus of said fluid equipment, is normal or abnormal.

9. The equipment diagnosis device according to any one of claims 1 to 8, characterized in that said equipment is the fluid equipment for circulating the fluid, and said judgement means discriminate a change in the physical quantities of the fluid indicating a nonconformity situation occurring when said fluid leaks from said equipment or the apparatus connected to said equipment, or sucked in a liquid state into said equipment,

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said equipment is deteriorated, a flow passage for circulating said fluid is clogged, bent or broken at any position, said fluid is deteriorated, or the operation of another constitutional apparatus connected to said flow passage of the fluid for said equipment is out of order, or judging that any abnormality thereof is included.

10. The equipment diagnosis device according to any one of claims 1 to 9, characterized in that the instrumentation amounts measured during the operation of said equipment are the physical quantities of the fluid, the quantities of electricity for driving said equipment driving means, or the quantities of electricity occurring from said equipment during the operation of said equipment, in which the quantities of electricity occurring during the operation of said equipment include an electromagnetic force, an electric wave, a leakage current and a shaft voltage.

11. The equipment diagnosis device according to any one of claims 1 to 10, characterized in that said judgement means judges whether or not said equipment is in the normal operating condition based on whether or not the state quantities in the current operating condition lie within a range of threshold indicating the normality or out of a range of threshold indicating the state quantities of the abnormal condition, and infers a failure time of said equipment from the relationship between the state quantities of the current operating condition

and the threshold.

12. A refrigerating cycle apparatus characterized by comprising:

a refrigerating cycle formed by connecting a compressor, a condenser, expansion means and an evaporator via a pipeline, and flowing a refrigerant through the inside thereof;

high pressure side measurement means that is high pressure measurement means for measuring the high pressure of a refrigerant pressure at any position on a flow passage leading from the discharge side of said compressor to said expansion means or condensation temperature measurement means for measuring the saturation temperature at said high pressure;

low pressure side measurement means that is low pressure measurement means for measuring the low pressure that is the pressure of refrigerant at any position on the flow passage leading from said expansion means to the suction side of said compressor or evaporation temperature measurement means for measuring the saturation temperature at said low pressure;

refrigerant temperature measurement means that is liquid temperature measurement means for measuring the temperature at any position on the flow passage leading from said condenser to said expansion means, discharge temperature measurement means for measuring the temperature at any position on the flow passage leading from said compressor to said condenser, or suction temperature measurement means for measuring the

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temperature at any position on the flow passage leading from said evaporator to said compressor;

arithmetic means for performing the arithmetic operation on the composite variables from the measured values of said high pressure side measurement means, said low pressure side measurement means and said refrigerant temperature measurement means; and

judgement means for judging the abnormality of the refrigerating cycle based on the comparison result by comparing the values stored in the past and the current measured values or arithmetic values, as well as storing each of said measured values or said arithmetic values.

13. A refrigerating cycle apparatus characterized by comprising:

a refrigerating cycle formed by connecting a compressor, a condenser, expansion means and an evaporator via a pipeline and flowing a refrigerant through the inside thereof;

normal state quantity storage means for storing, as the state quantities of a normal operating condition, the state quantities including at least the state quantity obtained by making the arithmetic operation on the correlation between a plurality of measured values as a plurality of variables when said refrigerating cycle is normally operating;

abnormal state quantity storage means for storing, as the state quantities of an abnormal operating condition, the

state quantities including at least the state quantity obtained by making the arithmetic operation on the correlation between the plurality of measured values as the plurality of variables when there is an abnormality in said refrigerating cycle;

5   comparison means for comparing the distances between the current operating state quantities including at least the state quantity obtained by making the arithmetic operation on the correlation between the plurality of measured values in the current operating condition of said refrigerating cycle as the

10   plurality of variables and the plurality of state quantities stored in said normal state quantity storage means or the plurality of state quantities stored in said abnormal state quantity means; and

judgement means for judging a degree of normality, an

15   degree of abnormality or a cause of abnormality of said refrigerating cycle from the distances compared by said comparison means or a change in the distance.

14.   The refrigerating cycle apparatus according to claim 12 or 13, characterized in that said judgement means for judging

20   the operating condition of said refrigerating cycle discriminates a refrigerant leakage from said refrigerating cycle, a refrigerant liquid back-flow to said compressor, a deterioration due to the lifetime of said compressor, a blemish or rupture on the surface of heat exchange for said condenser

25   or said evaporator, a deterioration or failure of a blower unit

of said condenser or said evaporator, clogging of a strainer

for removing the contaminant inside the pipeline through which

said refrigerant is circulated, clogging of a dryer for

preventing the humidity of refrigerant, a bend, rupture or

5   clogging of said pipeline, or a deterioration of a refrigerator

oil useful for said compressor, or discriminates whether or

not any of said abnormalities is involved.

15.   The refrigerating cycle apparatus according to any

one of claims 12 to 14, characterized by further comprising

10   learning means having at least one state quantity of a numerical

value representing the correlation of making the arithmetic

operation on said plurality of measured values, the plurality

of arithmetic values from said measured values, or said plurality

of measured values or arithmetic values as the plurality of

15   variables, and learning at least the numerical value

representing the correlation calculated as said plurality of

variables in learning the state quantities of the state where

said refrigerating cycle is normally operating.

16.   The refrigerating cycle apparatus according to any

20   one of claims 12 to 15, characterized in that said judgement

means for judging the operating condition of said refrigerating

cycle acquires a threshold for distinguishing between the normal

operating condition and the abnormal operating condition by

having said measured values or the arithmetic values such as

25   a mean value obtained by the arithmetic operation on said

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measured values, compulsorily converting at least one of said

measured values or said arithmetic values into another value,

and making the arithmetic operation on a plurality of variables

including the value after conversion.

17.   The refrigerating cycle apparatus according to any

one of claims 12 to 16, characterized in that the state quantities

of the abnormal operation used by said judgement means for

judging the operating condition of said refrigerating cycle

are obtained by compulsorily converting any one of said measured

values or said arithmetic values obtained by making the

arithmetic operation on said measured values into another value,

said values converted into said another value including the

measured value by refrigerant temperature measurement means

that is liquid temperature measurement means for measuring the

temperature at any position on the flow passage leading from

said condenser to said expansion means, discharge temperature

measurement means for measuring the temperature at any position

on the flow passage leading from said compressor to said

condenser, or suction temperature measurement means for

measuring the temperature at any position on the flow passage

leading from said evaporator to said compressor, or the

arithmetic value obtained by making the arithmetic operation

on the measured value.

18.   The refrigerating cycle apparatus according to any

one of claims 12 to 17, characterized by judging the degree

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of abnormality of said refrigerating cycle from the value obtained by making the arithmetic operation on an aggregate in which said plurality of variables are combined and associated with each other, and calculating the arithmetic operation result, and predicting a critical time at which said refrigerating cycle can not continue a stable operation.

19. The refrigerating cycle apparatus according to any one of claims 12 to 18, characterized in that in comparing the distances between the current operating state quantities including at least the state quantity of correlation of making the arithmetic operation on the plurality of measured values from the current operating condition of said refrigerating cycle as the plurality of variables, and the plurality of normal state quantities stored or the plurality of abnormal state quantities stored, a comparison is made between a refrigerant leakage amount that is the operated state quantity in the current operation or its equivalent arithmetic value and a preset refrigerant amount within said refrigerating cycle, a permissible refrigerant leakage amount or its equivalent state quantity, to predict the time to lead to a critical refrigerant amount capable of keeping the cooling power of said refrigerating cycle from the comparison result.

20. A refrigerating cycle apparatus characterized by comprising:

a refrigerating cycle formed by connecting a compressor,

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a condenser, expansion means and an evaporator via a pipeline and flowing a refrigerant through the inside thereof;

high pressure side measurement means that is high pressure measurement means for measuring the high pressure of a refrigerant pressure at any position on a flow passage leading from the discharge side of said compressor to said expansion means or condensation temperature measurement means for measuring the saturation temperature at said high pressure;

low pressure side measurement means that is low pressure measurement means for measuring the low pressure that is a pressure of refrigerant at any position on the flow passage leading from said expansion means to the suction side of said compressor or evaporation temperature measurement means for measuring the saturation temperature at said low pressure;

refrigerant temperature measurement means that is liquid temperature measurement means for measuring the temperature at any position on the flow passage leading from said condenser to said expansion means, discharge temperature measurement means for measuring the temperature at any position on the flow passage leading from said compressor to said condenser, or suction temperature measurement means for measuring the temperature at any position on the flow passage leading from said evaporator to said compressor;

judgement means for judging the abnormality of the refrigerating cycle including a refrigerant leakage by storing

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the measured values of said each measurement means or the arithmetic values calculated from said measured values, and comparing the stored values and the current measured values or arithmetic values; and

5   output means for outputting the refrigerant leakage information in preference to other abnormalities of the refrigerating cycle, when the refrigerant leakage is judged.

21.   The refrigerating cycle apparatus according to claim 20, characterized by further comprising arithmetic means for

10   performing the arithmetic operation on an aggregate in which a plurality of parameters obtained from three or more measured values measured by said each measurement means are combined as the plurality of variables and associated with each other to calculate the arithmetic value, normal state quantity storage

15   means for storing said measured values or the arithmetic values when said refrigerating cycle is normally operating, comparison means for comparing the distances between said arithmetic value obtained from said measured values in the current operating condition of said refrigerating cycle and the arithmetic value

20   stored in said normal state quantity storage means or the arithmetic value obtained by making the arithmetic operation on said stored measured values, and judgement means for judging the degree of normality, the degree of abnormality or the cause of abnormality for said refrigerating cycle from the distances

25   or a change in the distances compared by said comparison means.

22.   The refrigerating cycle apparatus according to claim
20 or 21, characterized by further comprising output means for
outputting the extent of abnormality of the refrigerant leakage
in said refrigerating cycle as an electric signal or
communicating it as a communication code with the outside, in
which a plurality of thresholds are set halfway in the distance
between said arithmetic values at the normal operating time
and the abnormal operating time, and the refrigerant amount
or refrigerant leakage amount within said refrigerating cycle,
or its equivalent arithmetic value, is set according to said
plurality of thresholds.

23.   The refrigerating cycle apparatus according to any
one of claims 12 to 22, characterized in that the arithmetic
value from said measured values, the numerical value
representing the correlation as the plurality of variables,
the value obtained by making the arithmetic operation on an
aggregate in which said plurality of variables are combined
and associated with each other and calculating the arithmetic
operation result, or said distance is the Mahalanobis distance
or the numerical value calculated from said Mahalanobis
distance.

24.   A fluid circuit diagnosis method characterized by
including:

a measurement step of measuring a plurality of measurement
amounts from the physical quantities of a fluid flowing through

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a circuit in the equipment sucking and discharging the fluid;

an arithmetic operation step of making the arithmetic operation on an aggregate in which a plurality of parameters obtained from said measured data are combined as a plurality of variables and associated with each other to calculate the arithmetic operation result; and

judgement step of judging whether or not said fluid is in the normal operating condition by comparing said arithmetic operation result with a set threshold.

25. The fluid circuit diagnosis method according to claim 24, characterized by further including a normal state storage step of storing the arithmetic operation result of said arithmetic means in a state where said fluid is normally running as a normal operating condition, an abnormal state storage step of storing the arithmetic operation result of said arithmetic means in a state where said fluid is abnormally running as an abnormal operating condition, and a step of setting a threshold halfway in the distance between said normal state and said abnormal state that are stored.

26. A fluid circuit diagnosis method characterized by including:

a measurement step of measuring a plurality of measurement amounts from the physical quantities of a fluid in the equipment sucking and discharging the fluid that circulates through a fluid circuit;

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an arithmetic operation step of making the arithmetic

operation on an aggregate in which a plurality of parameters

obtained from said measurement amounts that are measured are

combined as a plurality of variables and associated with each

5   other to calculate the arithmetic operation result; and

a failure preview step of presuming the time elapsed before

the fluid within said fluid circuit becomes abnormal from at

least one of the arithmetic operation result at the normal

operating time and the arithmetic operation result at the

10   abnormal operating time, said arithmetic operation results

being stored, and the operating time elapsed.

27.   The fluid circuit diagnosis method according to any

one of claims 24 to 26, characterized by further including a

normal state storage step of storing the arithmetic operation

15   result of said arithmetic means in a state where said fluid

is normally running as a normal operating condition, an abnormal

state storage step of storing the arithmetic operation result

of said arithmetic means in a state where said fluid is abnormally

running as an abnormal operating condition, and a failure preview

20   step of presuming the time elapsed before a leakage of the fluid

out of said fluid circuit reaches a preset critical value based

on a change in the distance between the current arithmetic

operation result of making the arithmetic operation on the

plurality of variables at present obtained from the measurement

25   values and at least one of the arithmetic operation result in

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the normal operating condition and the arithmetic operation result in the abnormal operating condition, said arithmetic operation results being stored.

28. The fluid circuit diagnosis method according to claim 27, characterized in that said failure preview step includes making the estimation at an interval, in which the arithmetic operation result at the normal operating time as the reference or the data stored as the plurality of variables is plural data learned at every elapsed time.

29. A fluid circuit diagnosis method characterized by including:

a measurement step of measuring a plurality of measurement amounts from the physical quantities of a fluid in the equipment sucking and discharging the fluid that circulates through a fluid circuit;

an arithmetic operation step of making the arithmetic operation on an aggregate in which a plurality of parameters obtained from said measurement amounts that are measured are combined as a plurality of variables and associated with each other to calculate the arithmetic operation result; and

a failure preview step of presuming the time elapsed before the fluid within said fluid circuit becomes abnormal from at least one of the arithmetic operation result at the normal operating time and the arithmetic operation result at the abnormal operating time, said arithmetic operation results

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being stored, and the operating time elapsed.

30. A fluid circuit diagnosis method characterized by including:

a step of reading the arithmetic operation result of making the arithmetic operation on an aggregate in which a plurality of measurement amounts that the physical quantities of a fluid the equipment sucking and discharging the fluid that circulates through a fluid circuit are measured and stored by a plurality of measurement means or a plurality of parameters obtained from said measurement amounts are combined as a plurality of variables and associated with each other from storage means connected to said fluid circuit for which a maintenance order from the maintenance order owner is accepted;

a step of judging whether or not the arithmetic operation result of making the arithmetic operation on the aggregate in which a plurality of parameters obtained from said read arithmetic operation results or said measurement amounts are combined as a plurality of variables and associated with each other lies within a preset range; and

a step of communicating the judgement results to the maintenance order owner;

wherein said judgement results include a plurality of proposals regarding the maintenance contents and the time.

31. An equipment monitoring system for monitoring the operating condition of the equipment operated by the equipment

diagnosis device according to any one of claims 1 to 11, characterized in that at least one of the instrumentation amounts measured by said equipment diagnosis device, the operated amounts obtained by arithmetic operation, and the judgement result as to whether or not said equipment is in the normal operating condition by comparing said arithmetic values within a set threshold is transmitted via a communication line or the radio communication to a remote monitoring apparatus for monitoring the operating condition of the equipment.

32. An equipment monitoring system characterized by comprising failure preview means for presuming the time taken until a failure of the equipment occurs based on the arithmetic operation result at the normal operating time, the current arithmetic operation result being obtained by making the arithmetic operation on a plurality of instrumentation amounts obtained from the current operating condition of said equipment diagnosis device according to any one of claims 1 to 11, and the time elapsed since the arithmetic operation result is stored.

33. A refrigerating cycle monitoring system characterized by comprising a remote monitoring apparatus for monitoring the operating condition of said refrigerating cycle apparatus according to any one of claims 12 to 23, wherein at least one of the measurement values measured by said refrigerating cycle apparatus, the arithmetic values obtained by arithmetic operation, and the judgement result as to whether

or not said refrigerating cycle apparatus is in the normal
operating condition by comparing said arithmetic values are
within a set threshold is transmitted via a communication line
or the radio communication.

5   34. A refrigerating cycle monitoring system
characterized by comprising:

high pressure side measurement means that is high pressure
measurement means for measuring the high pressure of a
refrigerant pressure at any position on a flow passage leading
10   from the discharge side of a compressor to expansion means in
a refrigerating cycle apparatus that constitutes a
refrigerating cycle by connecting said compressor, a condenser,
said expansion means and an evaporator via a pipeline and flowing
a refrigerant through the inside thereof or condensation
15   temperature measurement means for measuring the saturation
temperature at said high pressure;

low pressure side measurement means that is low pressure
measurement means for measuring the low pressure that is a
pressure of refrigerant at any position on the flow passage
20   leading from said expansion means to the suction side of said
compressor or evaporation temperature measurement means for
measuring the saturation temperature at said low pressure;

refrigerant temperature measurement means that is liquid
temperature measurement means for measuring the temperature
25   at any position on the flow passage leading from said condenser

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to said expansion means, discharge temperature measurement means for measuring the temperature at any position on the flow passage leading from said compressor to said condenser, or suction temperature measurement means for measuring the

5 temperature at any position on the flow passage leading from said evaporator to said compressor;

arithmetic means for acquiring the composite variables from the measured values of said high pressure side measurement means, said low pressure side measurement means and said

10 refrigerant temperature measurement means;

storage means for storing the measured value of said each measurement means and the arithmetic values such as the composite variables by making the arithmetic operation on said measured values;

15 judgement means for judging the abnormality of said refrigerating cycle based on the comparison result by comparing the values stored in the past by said storage means and the current measured values or arithmetic values; and

transmission means, formed by wire or radio, for

20 transmitting said measured values or the arithmetic values or the judgement result of said judgement means to a remote monitoring apparatus provided at a site away from said refrigerating cycle apparatus.

35. A refrigerating cycle monitoring system

25 characterized by comprising:

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normal state storage means for storing the state

quantities in the normal operating condition that are acquired

or inferred by making the arithmetic operation on the correlation

between a plurality of variables from the measurement results

5   when a refrigerating cycle formed by connecting a compressor,

a condenser, expansion means and an evaporator via a pipeline

and flowing a refrigerant through the inside thereof is normally

operating;

abnormal state storage means for storing the state

10   quantities in a plurality of abnormal states that are acquired

by making the arithmetic operation on the correlation between

a plurality of variables from the measurement results of the

operation when there is an abnormality in the circulation of

the refrigerant in said refrigerating cycle, or storing a

15   plurality of abnormal state quantities obtained by regenerating

the plurality of abnormal states;

comparison means for comparing the distances between the

state quantities obtained from the current operating condition

of said refrigerating cycle and the state quantities stored

20   in said normal state storage means or the plurality of state

quantities stored in said abnormal state storage means; and

judgement means for judging the degree of normality, the

degree of abnormality or the cause of abnormality in said

refrigerating cycle from the distances compared by said

25   comparison means or a change in the distance;

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wherein at least one of said current state quantities, the distances compared by said comparison means or the change in the distance, and the degree of normality, the degree of abnormality or the cause of abnormality for said refrigerating cycle judged by said judgement means is transmitted by transmission means formed by wire or radio.

36. A refrigerating cycle monitoring system according to claim 34 or 35, characterized in that the information as to the presumed time taken until a failure of the equipment occurs based on the arithmetic values measured and calculated at the normal operating time and the operating time elapsed of the refrigerating cycle, the arithmetic values being measured and calculated in the current operating condition, is transmitted and displayed to a remote monitoring apparatus via said transmission means.

37. The refrigerating cycle monitoring system according to any one of claims 34 to 36, characterized by further comprising normal state storage means for learning and storing the arithmetic operation result of said arithmetic means as a normal operating state in a condition where said refrigerating cycle is normally operating, abnormal state storage means for learning and storing the arithmetic operation result of said arithmetic means as an abnormal operating state in a condition where said refrigerating cycle is abnormally operating such as a refrigerant leakage, and a plurality of thresholds set halfway

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in the distance between arithmetic operation results of the normal state and the abnormal state that are stored, wherein the distance between the arithmetic operation result of the current operating condition and said threshold or a temporal change in the distance is displayed in said remote monitoring apparatus.

38. The refrigerating cycle monitoring system according to any one of claims 34 to 37, characterized by further comprising output means for setting the refrigerant amount or refrigerant leakage amount within said refrigerating cycle as the arithmetic value equivalent to each amount and outputting the abnormality of said refrigerating cycle as an electric signal or communicating it as a communication code, wherein if a refrigerant leakage, if detected, is outputted to said remote monitoring apparatus prior to other judgement results of said judgement means.

39. A refrigerating cycle monitoring system comprising:

normal state storage means for storing the arithmetic operation result of making the arithmetic operation on the correlation between the physical quantities of a refrigerant in a condition where the refrigerant flowing through a refrigerating cycle is normal, as a normal operating state, abnormal state storage means for storing the arithmetic operation result of making the arithmetic operation on the correlation between the physical quantities of the refrigerant

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in an abnormal condition where said refrigerant leaks out of said refrigerating cycle, and refrigerant leakage foreseeing means for foreseeing the time when said refrigerant leaks out of said refrigerating cycle by comparing the distances between the arithmetic operation result of making the arithmetic operation on the correlation between the physical quantities of the refrigerant in the current operating condition and at least one of the normal operating condition and the abnormal operating condition that are stored, wherein the foreseen result of said refrigerant leakage foreseeing means is transmitted to a remote monitoring apparatus.